Fisheries Leaflet No. 187 2002

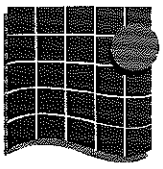
Deepwater longline survey on the continental slopes of Porcupine Bank, Rockall Bank and Hatton Bank

Maurice Clarke

Sara Jane Moore

Marine Institute
Foras na Mara

ISSN 0332 1789



Marine Institute
Foras na Mara

Fisheries Leaflet No. 187 (2002)

Deepwater longline survey on the continental slopes of Porcupine Bank, Rockall Bank and Hatton Bank

by

Maurice Clarke and Sara Jane Moore

Marine Institute, Rinville, Oranmore, Co. Galway, Ireland

ISSN 0332-1789

Abstract

A deepwater survey programme has been operated since 1993 by the Marine Institute (MI), in the deep waters of the Rockall Trough and Porcupine Bank. The first leg of the present survey took place over a period of 12 days in August 2000 on the Western slope of the Porcupine Bank and the western slopes of Rockall Bank and Hatton Bank. The second leg took place on the slopes and shelves of the Porcupine Bank. Fishing was carried out in depths between 150 and 1,800 meters. The primary objective of the survey was to obtain biological samples of chondricthyan and teleost fish, for contaminant analysis of fish by the MI chemistry section and for food technology analysis at the Teagase National Food Centre. The survey was carried out on the commercial long-liner "*An Capall Bán*," using commercial deep-water autoline gear. In total 26 species of chondricthyan and 24 species of teleost fish were taken. Among the most abundant species in the catch were birdbeak dogfish (22%), leafscale gulpershark (14%), Portuguese dogfish (8%), tusk (17%) and mora (8%). Over the entire survey, discarding was estimated at 43% of the total catch. The main species discarded were birdbeak dogfish and greater lantern shark. Catch per unit effort showed that highest abundances were found in the northwestern slope of the Porcupine Bank at 600 – 700 metres and in the western slopes of Rockall Bank and Hatton Bank at 1,000 to 1,200 metres depths.

Introduction

This long-line survey was carried out as part of the Marine Institute Deep Water Survey Programme. The Marine Institute began a deepwater research survey programme in 1993. This is the 4th long-line survey of the series and 5 trawl surveys have also been completed. The survey programme was initiated to obtain samples of deepwater fish for biological analysis. The surveys have also provided material for food technology and contaminant studies. They have produced time series of catch per unit effort (C.P.U.E.) and discarding information. The first long-line survey (1995) was carried out using the converted long-liner *Sea Sparkle* from Greencastle, Co Donegal and covered the continental slopes of both the Rockall Trough and to a lesser extent, the Porcupine Bank. The second survey (1997) using the Norwegian vessel *Skarheim* covered the Rockall Trough only. The third survey (MFV *Loran*) concentrated on the Porcupine continental slopes and those to the south west of Ireland along the Porcupine Sea Bight, thus achieving coverage of all the continental slopes within the Irish 200 miles Exclusive Economic Zone.

This survey covered northern slopes of Porcupine Bank and areas previously not investigated; western Rockall and Hatton Bank. It took place as interest in the deepwater fisheries resources increases. At present fleets of several countries are fishing deepwater species in these areas. The Rockall and Porcupine areas are the subject of much interest on the part of Norwegian and Spanish long-liners. At Hatton, a new Norwegian fishery for Greenland halibut has developed recently. Irish vessels have also shown interest and it seems likely that exploitation of deepwater fish in these areas will increase. However the latest advice from ICES has been that effort on many deepwater species should be reduced and that new fisheries should only be developed in tandem with the collection of adequate scientific data. It is against the backdrop of this advice that the 4th deepwater long-line survey was planned. As longline fishing for deepwater species in Ireland only began in 2000, the Marine Institute aimed to begin collecting biological and catch rate data that are otherwise impossible to obtain. The difference in species composition, C.P.U.E. estimates and discarding rates of long-line gears were also investigated.

Personnel

Maurice Clarke (Chief Scientist)	Marine Institute MFSD
Sara-Jane Moore	Marine Institute MFSD
Jennifer Doyle (Part A)	Marine Institute MFSD
Gráinne Ní Chonchúir (Part B)	Marine Institute MFSD

Materials and Methods

The sample design involved setting lines in 4 different areas (Figure 1) in the depth strata 200- 500m, 500 – 700 m, 700 – 900 m, 900 – 1,100 m, 1,100 m – 1,300 m and 1,300 m – 1,500. In total 47 fleets of longlines were set, and the total number of hooks on these lines was 112,136.

The vessel used was *An Capall Ban* a 25 m auto-liner based in Galway. The vessel details are: built, 2000; length, 24.9 m (Reg. 22.5 m); beam, 8 m; draught, 3.9 m; main engine: Caterpillar developing 750 b.h.p. horse power; gear capacity 28,000 hooks. Volume of fresh hold, 100 m^3, freezer hold, 23.7 m^3 and bait hold, 14 m^3.

Lines of 9 mm were used. They were shot in magazines (1,020 hooks). The hook size used was Mustad 13/0 EZ. Snoods were of 40 – 70 cm in length attached to the main line by swivels at a maximum interval of 1.4 m. The interval between swivels was not less than twice the snood length to avoid fouling. Fishing was carried out in the depth strata 500 – 700 m, 700 – 900 m, 900 – 1,100 m, 1,100 m – 1,300 m and 1,300 m – 1,500, where such were available. The bait used was squid. However the usefulness of artificial baits manufactured by the Celtic Bait Company, Co Wicklow, was investigated also.

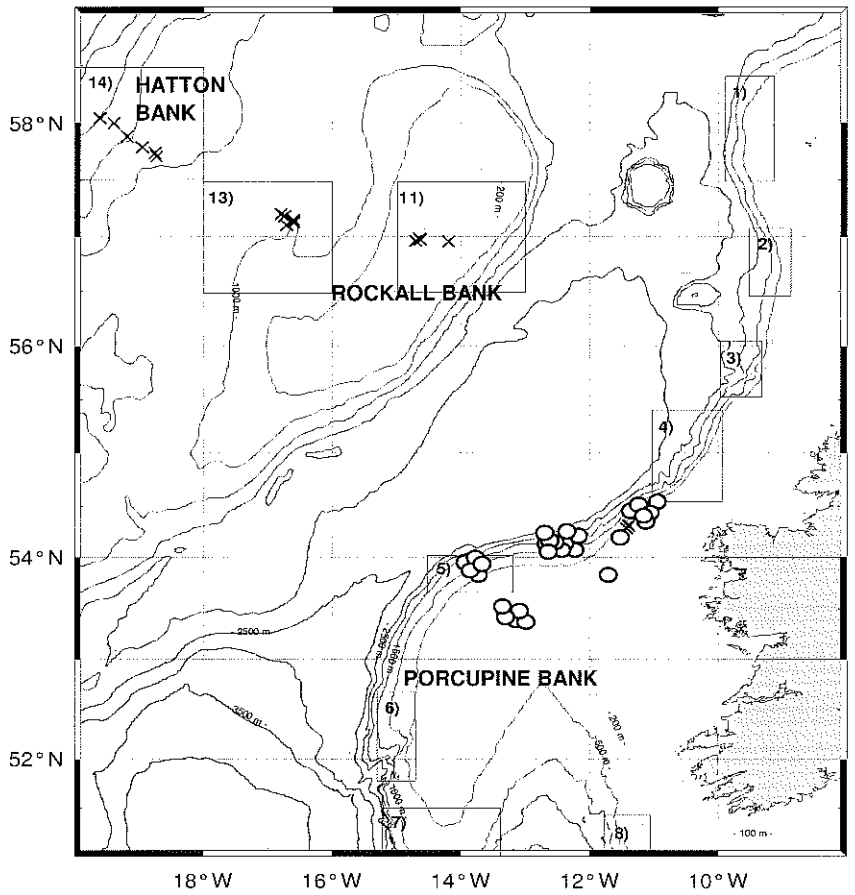


Figure 1. Shoot positions for deepwater long-line survey 20th August to 31st August 2000. (X) and positions for the survey 15th September to 26th September 2000 (O).

Species were identified according to Stehmann (1998), Whitehead (1984), and Compagno (1984). Length measurements of total catch were taken as the lines were hauled. Weight information was also taken for every species. This was used to develop length-weight regressions that were used to obtain estimates of total weight. Otoliths of blue ling and tusk were removed and length, weight, sex and maturity information recorded on hauling. These otoliths were stored in 70 % alcohol. Otoliths of mora were stored dry in plastic trays. Specimens of unidentified fish were frozen for analysis at the laboratory. Samples of many of the species were frozen for food technology and product development work. Specimens of coral taken on long-line were frozen for analysis by the Martin Ryan Institute, NUI Galway, as part of the ACES Coral Ecosystem study contract. Muscle tissue from fish taken on coral areas was secured for Stable Isotope.

Table 1. Number of longline settings (n) and hooks deployed by areas and depth strata during the survey.

Depth interval	Hatton bank		Porcupine bank		Rockall bank		Total	
200 - 499 m			9	24,640	3	7,840	12	32,480
500 - 699 m	2	4,480	10	23,656	1	2,240	13	30,376
700 - 899 m	1	2,240	3	5,600	1	2,240	5	10,080
900 - 1099 m	1	2,240	5	12,320	1	2,240	7	16,800
1100 -1299 m			3	8,960	2	4,480	5	13,440
1300 - 1500 m	1	2,240			1	2,240	2	4,480
1500 - 1800 m	1	2,240	2	2,240			3	4,480
Total	6	13,440	32	77,416	9	21,280	47	112,136

Results and Discussion

Survey Narrative: Part A

Day 1; 20 August 2000

Left Galway at 1030 hrs stopped at Ros a'Mhíl to pick up crew members. Left Ros a'Mhíl at 1215 hrs. Began steam for Hatton Bank.

Day 2; 21 August 2000

Stopped steaming at 0630 hrs to investigate floating dahn, picked up this gear at 56° 360 N and 16° 090 W. The vessel name on buoy was Meridian, this vessel is a gillnetter, specialising in fishing deep water areas. Resumed steam to Hatton.

Day 3; 22 August 2000

Arrived at south side of Hatton Bank. Shot first set at 0720 hrs at 624 m depth. Second set shot at 1027 hrs in 680 m. Hauled first line at 1320 hrs, there was some coral on the lines, a known habitat of tusk. About 6 boxes of tusk this haul. Most

numerous was blackmouth dogfish. This species also dominated the second haul at 1755 hrs. There was some blue ling and tusk also and one single Greenland halibut. Line 3 was shot at 1655 hrs at a depth of 820 m. The bottom was soft and the anchor dragged some distance on hauling. The catch on this line was poor, mostly birdbeak and blackmouth dogfish, small amounts of mora and blue ling. One specimen of leafscale gulper shark had 3 baited hooks in its stomach and a fourth in its mouth, indicating the strength and voracity of this species. Weather good, calm, west to northwest. A Spanish gill-netter was operating to the South, on the Fangorn Bank targeting sharks. The skipper of this vessel reported that that area was rich in coral.

Day 4; 23 August 2000

Shot line 4 at 0820 hrs. Did not shoot further sets because of worsening weather, a southwest gale force 7. Had trouble locating dahn. The anchor dragged north-eastwards. Skipper stated that a drift in this direction is a feature of the deeper waters west of Hatton Bank. Catch was dominated by sharks, suggesting that teleost fish had been shaken off the hooks on hauling due to the pitch of the vessel. Shot line 5 at 1845 hrs, when weather moderated to force 4-5, westerly. Hauled line late in the evening, catch again dominated by sharks. Many teleost fish were damaged, probably by sharks. There were also many damaged snoods. Skipper observed many blue ling falling off the hooks due to the pitch of the vessel on hauling. Weather deteriorating.

Day 5; 24 August 2000

Shot line 6 at 0720 hrs at a depth of 1,400 m, using only one magazine. MFV *Loran* arrived at our position at 0830 hrs and fishing gear was transferred to her. Hauled line 6 at 1325 hrs, catch very poor with many baits intact on the hooks. The main species was blue antimora *Antimora rostrata,* with some roughhead grenadier *Macrourus berglax.* It was decided not to fish any more in Area 14 due to bad weather forecast and poor returns. After hauling began steam southeast to Area 13.

Day 6; 25 August 2000

Set line 7 at 0825 hrs on summit of Area 13. This area was hilly and the bottom quite hard. The anchor did not take the bottom at first. Many tusk on this line, but only a few blackmouth dogfishes. Set line 8 at 1035 hrs. Catch on this deeper line mainly shark*; C. crepidater, D. calceus* and *Galeus melastomus.* Line 9 was hauled at 2055 hrs, having been shot at 1510 hrs. Japanese tuna long-line gear was taken on this line. Again the catch was dominated by small sharks. Noteworthy was the relatively

small number of leafscale gulper shark in this area and Area 14. In the depth range 600 – 900 m on the continental slopes west of the Hebrides and Donegal. Weather very favourable, slight breeze from the southwest.

Day 7; 26 August 2000

Set line 10 at 0700 hrs at 1,240 m and line 11 at 0800 in 1,300 m. Hauled first line at 1230 hrs. Catch poor, some Portuguese dogfish, very small numbers of blue ling, and mostly dominated by small sharks. A Japanese tuna long-liner was present within 4 miles of the survey vessel. Set line 11 at 0800 hrs, this line was hauled at 1835 hrs. Weather good, slight southwest wind. Catch poor, mostly small sharks, some Portuguese dogfish. Noteworthy was a single Greenland halibut. The remaining time on the survey was allocated to commercial fishing operations. Line 12 was set at 1700 hrs. Weather good. On hauling this line at sundown, the dahn line broke, so the vessel remained in position until daybreak to haul from other end.

Day 8; 27 August 2000

Hauled line 12 at 0710 hrs. Catch dominated by birdbeak dogfishes. Some blue ling and tusk, many damaged. It was decided to fish in an area of "bad ground" where trawlers could not fish. Set line 13 at 1555 hrs and line 14 at 1,640 m at a depth of 169 m on the Rockall Plateau in an area marked "bad ground" on a trawling chart. A large Scottish trawler was working to the east of this position. The weather remained calm and the line was hauled at 2220 hrs. Small catches of tusk, ling and haddock were taken on each line, with little discarding. It was decided to remain in this area and set at dawn in order further investigate the commercial viability of shallow water fishing in this area of the Rockall Trough.

Day 9; 28 August 2000

Line 15 and 16 were set at 0605 hrs and 0645 hrs. These lines were hauled in the afternoon and the catches were encouraging, with some large ling and tusk and some haddock. There was evidence of coral in this area, and some old gill nets were found. After hauling *An Capall Bán* began to steam southeast to the north side of the Porcupine Bank where good marks of mora and tusk were taken on the trip previous to this survey. Two large (Russian?) factory trawlers were operating, one to the northwest and the other to the southeast of the hauling position of line 16.

Day 10; 29 August 2000

Arrived at the grounds and set 3 magazines at 1230 hrs. Weather calm. Hauled line at 1720 hrs. Catch good with 11 boxes of tusk, and much mora. Lost lines, 300 m in

total. Shot line 18 at 2110 hrs and line 19 at 2225 hrs. A Norwegian auto-liner was working in this area also.

Day 11; 30 August 2000

Began hauling line 18 at 0710 hrs. The dahn had drifted to the south, and the line had to be cut because of the great pressure. Hauling was resumed at the other end. The line broke again and 4 lines were lost. Catch good, much tusk and mora. Line 19 was hauled at 1300 hrs without difficulty, but the catch was poor with many rabbitfish and bird-beaks. Began steam for Galway after hauling this line.

Day 12; 31 August 2000

Arrived in Galway at 0545 hrs. Survey equipment and samples obtained landed and transported to laboratory.

Survey Narrative: Part B

Day 1; 15 September 2000

Loaded equipment and bait on vessel in Ros a'Mhíl.

Day 2; 16 September 2000

Departed Ros an Mhíl at 0000 hrs. Began steam for southern slopes of the Rockall Trough. Set first line (4 magazines) at 1140 hrs along top of slope parallel to the 500 m isobath. There was some evidence of coral in this area. Line 2 was set at 1230 hrs (3 magazines) further west. Both lines were for commercial fishing purposes. Line 1 was difficult to haul and the buoy line broke. Commenced hauling at other end, but this broke also, leading to the loss of 3 magazines. Catch on this line poor, mainly tusk. Hauled line 2 at 1705 hrs. Catch again poor, with many fish damaged by skinners. Many of the ling taken on this line were damaged or actually entangled in gill-net twine. The twine was old and broke easily. This indicates that these nets have been abandoned or lost. It seems that ghost fishing may be a problem in this area. Line 3 was set at 1330 hrs in 800 m. Catches were quite good with mora, tusk and greater forkbeard.

Day 3; 17 September 2000

Spent early morning creeping for missing lines, but to no avail. Line 4 set at 0727 hrs in 1,000 m line 5 shot at the same depth. Line 6 was set in 1395 m using only one anchor. Catch on line 4 was mainly blue ling and mora. Line 5 broke, probably due to coral cutting the line. Hauled from other end, catch mainly bird-beak dogfish. Line 6 was tangled up, only a few small sharks present.

Day 4; 18 September 2000

Set line 7 at 0630 hrs in 1,200 m. Line 8 and line 9 were set at 0730 hrs and 0940 hrs respectively. Hauled this line at 1105 hrs, catch mainly leafsacale gulpershark, few Portuguese dogfish. Weather remaining good, force 4 – 5 south westerly. Line 9 was hauled next, a magazine was nearly lost. Line 8 was hauled at 1855 hrs. Weather deteriorating with large swells, wind southwest, veering northwest force 6 - 8. Line 10 was set at 1745 hrs in 1,800 m.

Day 5; 19 September 2000

After hauling line 10 began steam for Porcupine Bank. Arrived at Porcupine at 1015 hrs. Weather very poor so it was decided to dodge for a while until the weather improved. Set line 11 at 0344 hrs on eastern side of Porcupine Bank in an area marked as rough ground and coral on trawl charts. Line 12 was set in same area using artificial bait. Catch rates on both lines poor, so not possible to determine suitability of artificial baits.

Day 6; 20 September 2000

Set 3 lines, of 3 magazines each, on the Porcupine Bank in parallel. The middle line was baited with No. 006 bait, the others with squid. The ground was hard and rough. Catch rate on line with artificial bait was lowest, with only 6 fish, though catch rates in general were poor, mainly cuckoo ray. The main prey item in the stomachs of the rays was Dublin Bay prawn.

Day 7; 21 September 2000

Set line 16 in early morning in 1,150 m. A large unidentified fishing vessel was steaming east of the shooting position. Set 2 lines in parallel one with squid, the other with No. 004 artificial bait. The bottom was dominated by coral *Lophelia pertusa*. Catches on both lines were poor, however the artificial baits appear to disintegrate, with only the elastic casing visible on the boarded hooks. Another problem with the artificial baits is that the elastics get tangled in the hook separator leading to a build up of debris. On the shallower part of these lines, Spanish demersal long-line gear was found. Line 19 was set at 1726 hrs at 900 m. Catch consisted mainly of mora with some tusk. The dahn had drifted over a mile northeast of the shooting position. Spent night trying to locate line 16 that was not in the vicinity of the shoot position. Weather good, westerly breeze.

Day 8; 22 September 2000

Set line 20 at 0720 hrs at 560 m, in shallower waters to lines 17 and 18. Tusk and ling, with encouraging quantities of each, dominated catches. The transducer cable from an RSW vessel was entangled on this line. Returned to the search for line 16, which was located at 1640 hrs 10 miles north west of original position. Catch was poor from line 16. However the drifting line picked up several gill nets that were drifting in the area. Benthic fauna, including crabs were entangled in these nets. It is possible that a trawler towed through this line. However a strong northeasterly flowing current was also present. Catch mainly mora with birdbeak dogfish the main discard. Wind southeast force 4 - 5.

Day 9; 23 September 2000

Line 21 was set at 0750 hrs. Line 22 was set at 0830 hrs. The catch on line 21 was poor. Line 22 yielded good catches of leafscale gulper shark, Portuguese dogfish and mora. Line 23 was set at 1427 hrs at 960 m. Weather deteriorated, force 5 – 6 southeasterly. Catch from line 23 was mainly Portuguese dogfish. Line 24 was set at 1847 hrs in 718 m. Catch mainly birdbeak dogfish. Norwegian long-liners, operating in this area during the previous survey, were now absent.

Day 10; 24 September 2000

Set line 20 at 0720 h at 560 m, in shallower waters than lines 17 and 18. Tusk and ling, with encouraging quantities of each, dominated catches. The transducer cable from an RSW vessel (blue whiting?) was entangled on this line. Returned to the search for line 16, which was located at 1640 h, 10 miles north west of original position. Catch was poor from line 16. However the drifting line picked up several gill nets that were in the area. Benthic fauna, including crabs were entangled in these nets It is possible that a trawler towed through this line. However a strong north easterly flowing current was also present Catch mainly mora with birdbeak dogfish the main discard. Wind south east 4 - 5.

Day 11; 25 September 2000

Set line 28 at 0712 hrs in shallower waters than previous day, at 308 m. Catches very poor, with many skinners on the ground and little bait left on the hooks. After hauling began steam for Ros an Mhil at 1130 hrs. Arrived in Ros an Mhil at 2130 hrs, some crew and scientific personnel left the vessel.

Day 12; 26 September 2000

Steamed for Galway, arriving at 0400 hrs on the 26th September. Scientific equipment and samples off loaded and taken back to laboratory.

Catch Data

The total catch during the survey was 28,507 kg (Table 2). The most abundant species was birdbeak dogfish (22%). This species has no commercial value and was discarded. The two commercial squalid shark species, Portuguese dogfish and leafscale gulper shark combined, contributed 29% of the catches. The four commercial bony fishes, mora, greater forkbeard, ling, and blue ling comprised 26.5% of the total catch. Discard species amounted 43% of the total catch. The catch per 1,000 hooks for each longline setting is shown in Appendix 1.

Table 2. Species caught during the survey (Total weight in kg).

Species	common name	KG	%
Deania calceus	birdbeak dogfish	6,383	22.39
Brosme brosme	tusk	4,797	16.83
Centrophorus squamosus	leafscale gulpershark	3,867	13.56
Centroscymnus coelolepis	Portuguese dogfish	2,137	7.50
Mora moro	mora	1,801	6.32
Etmopetrus princeps	lantern shark	1,453	5.10
Centroscyllium fabricii	black dogfish	1,204	4.22
Molva molva	ling	1,095	3.84
Centroscymnus crepidater	long nosed velvet dogfish	1,065	3.74
Phycis blennoides	fork beard	874	3.07
Helicolenus dactylopterus	bluemouth	768	2.69
Chimaera monstrosa	rabbitfish	714	2.50
Molva dypterigia	blue ling	598	2.10
Galeus melastomus	blackmouth dogfish	376	1.32
Melanogrammus aeglefinnus	haddock	212	0.74
Etmopterus spinax	velvet belly	211	0.74
Raja circularis	sandy ray	142	0.50
Hydrolagus affinis	smalleyed rabbitfish	115	0.40
Raja naevus	cuckoo ray	111	0.39
Scylorhinus canicula	smallspotted catshark	69	0.24
Scymnodon ringens	knifetooth dogfish	58	0.21
Apristurus laursoni	Iceland catshark	56	0.20
Hydrolagus pallidus		44	0.15
Raja batis	Skate	42	0.15
A.denticulatus	monkfish	40	0.14
Lophius piscatorius	black monk	39	0.14
Raja nidarosiensis	Norwegian skate	28	0.10
Macrourus berglax	roughhead grenadier	27	0.09
Lepidion eques		19	0.07
Antimora rostrata	blue hake	18	0.06
Pollachius virens	saith	17	0.06
Dalatias licha	kite fin shark	15	0.05
Hexanchus griseus	six-gill shark	15	0.05
Galeus murinus	mouse catshark	12	0.04
Raja fullonica	shagreen ray	12	0.04
Raja fyllae	round ray	10	0.04
Reinhardtius hippoglossoides	Greenland halibut	10	0.04
Squalus acanthias	spurdog	9.4	0.03
Aphanopus carbo	black scabbard	8.5	0.03
Gadus morhua	cod	7.7	0.03
Synaphobranchus kaupi	Kaup's eel	5.1	0.02
Coelorhynchus coelorhynchus	blackspot grenadier	3.7	0.01
Lepidorhombus whiffagonis	megrim	3.6	0.01
Grenadier spp.		3.5	0.01
Raja montagui	spotted ray	3.4	0.01
Conger conger	conger eel	2.8	0.01
Lepidion schmidti		2.8	0.01
Sebastes mentella	deepwater redfish	1.7	0.01
Coryphanoides rupestris	roundnose grenadier	0.48	0.002
Raja bigelowi	Bigelow´s ray	0.47	0.002
Eutrigla gurnardus	grey gurnard	0.29	0.001
Total		28,507	100.00

Ling (*Molva molva*)

The total live-weight catch of ling was 1,095 kg (Table 2). Highest catches were recorded on the Porcupine slope. At Hatton Bank this species was not recorded. The absolute depth range for this species was 170m – 960m. Peak catch rates of ling came from 500 m to 600 m. (Table 3). The smallest length recorded was 47 cm for females and 57 cm for males. The greatest lengths were 130 cm for males and 126 cm for females (Figure 2).

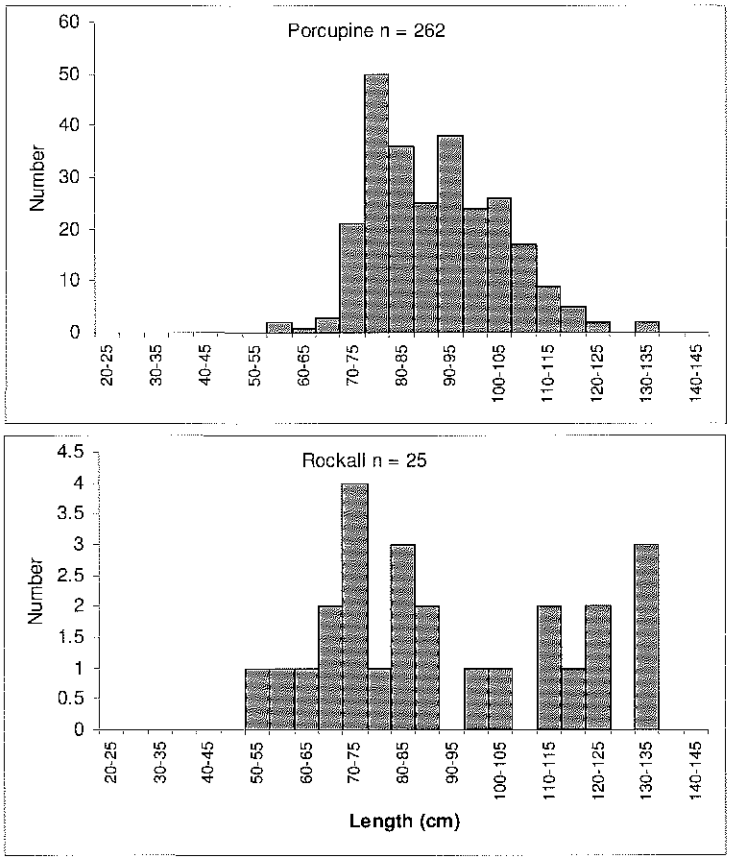


Figure 2. Length frequency distribution for ling (*Molva molva*).

Table 3. Ling *(Molva molva),* catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	9.4	7.6	9.0
500 - 699 m	0.0	33.3	0.0	26.0
700 - 899 m	0.0	0.6	0.0	0.3
900 - 1099 m	0.0	0.9	0.0	0.7
1100 -1299 m	-	0.0	0.0	0.0
1300 - 1500 m	0.0	-	0.0	0.0
1500 - 1800 m	0.0	0.0	-	0.0
Total	0.0	13.4	2.8	9.8

Tusk (*Brosme brosme*)

The total catch of tusk was 4,797 kg (Table 2). Relatively high commercially significant catches were recorded in all three areas. The absolute depth range for this species was 170 m – 1,050 m. Peak catch rates (Table 4) of tusk came from 500 m to 750 m. The smallest length recorded was 34 cm for females and 41 cm for males. The greatest lengths were 100 cm for males and 93 cm for females (Figure 3).

Table 4. Tusk (*Brosme brosme*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	16.4	69.9	29.4
500 - 699 m	159.4	89.4	125.1	102.4
700 - 899 m	21.9	47.3	89.8	51.1
900 - 1099 m	5.1	12.2	26.0	13.1
1100 -1299 m	-	0.0	0.0	0.0
1300 - 1500 m	0.0	-	0.0	0.0
1500 - 1800 m	0.0	0.0	-	0.0
Total	57.6	37.9	51.1	42.8

Mora (*Mora moro*)

The total catch of mora was 1,801 kg (Table 2). Highest catches were recorded from the Porcupine slopes. The absolute depth range for this species was 600 m – 1,130 m. Peak catch rates of mora came from 600 m to 1,050 m (Table 5). The smallest length recorded was 32 cm for females and 34 cm for males. The greatest lengths were 66 cm for males and 77 cm for females (Figure 4).

Table 5. Mora (*Mora moro*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	0.1	0.0	0.1
500 - 699 m	0.1	23.7	8.1	19.1
700 - 899 m	17.5	21.5	22.4	20.8
900 - 1099 m	0.0	76.3	28.8	59.8
1100 -1299 m	-	0.1	0.8	0.3
1300 - 1500 m	0.0	-	0.0	0.0
1500 - 1800 m	0.0	0.0	-	0.0
Total	2.9	21.0	6.4	16.1

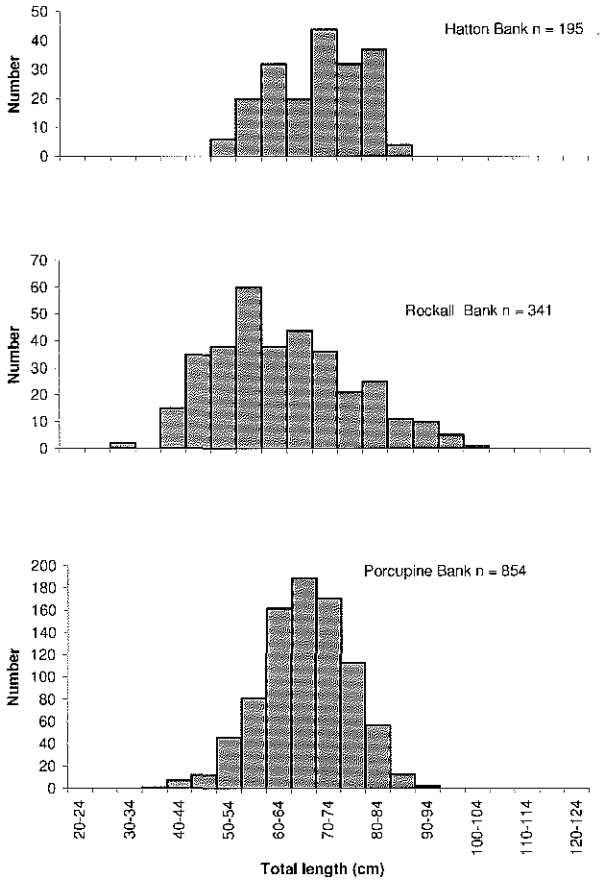


Figure 3. Length frequency distribution for tusk (*Brosme brosme*)

Greater forkbeard (*Phycis blennoides*)

The total catch of greater forkbeard was 874 kg (Table 2). Highest catches were recorded on the Porcupine slope (Table 6). The absolute depth range for this species was 300 m – 1,050 m. Peak catch rates came from 500 m to 699 m. The smallest length recorded was 27 cm and the greatest was 83 cm (Figure 5). Two single fish were caught at Hatton Bank, both were 48 cm. Also two fish were caught at Rockall Bank, these were 57 and 65 cm.

Table 6. Greater forkbeard (*Phycis blennoides*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	1.5	0.0	1.1
500 - 699 m	0.5	31.4	0.0	24.5
700 - 899 m	0.0	8.0	1.5	4.8
900 - 1099 m	0.0	3.7	0.0	2.7
1100 -1299 m	-	0.0	0.0	0.0
1300 - 1500 m	0.0	-	0.0	0.0
1500 - 1800 m	0.0	0.0	-	0.0
Total	0.2	11.2	0.2	7.8

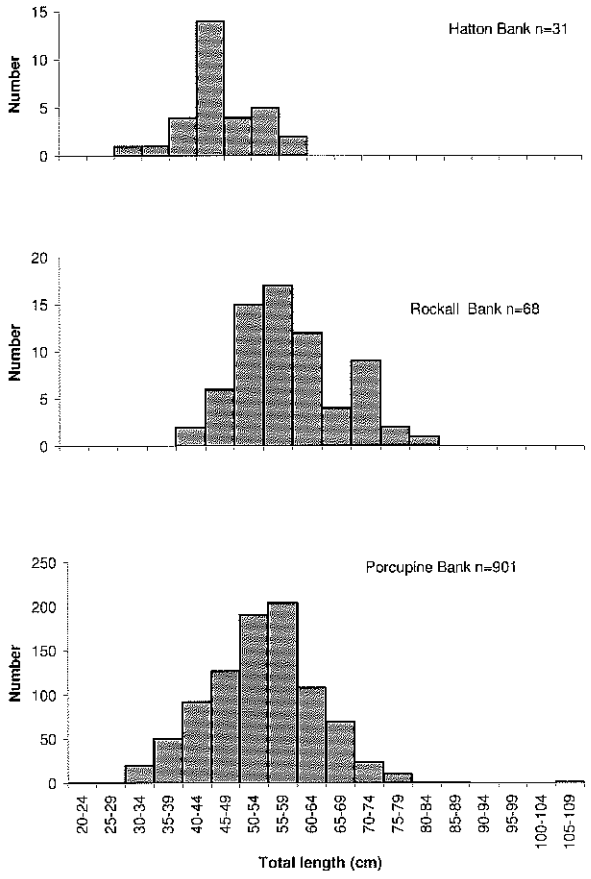


Figure 4. Length frequency distribution for mora (*Mora moro*)

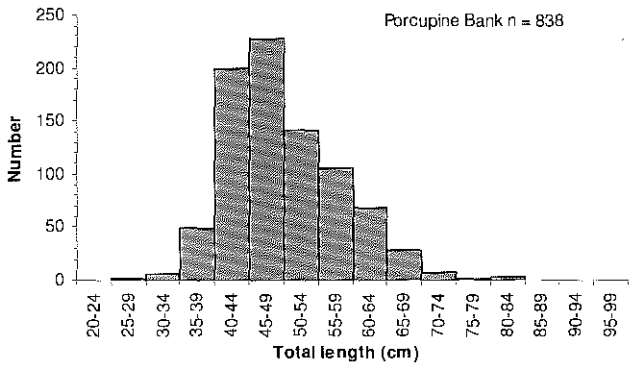


Figure 5. Length frequency distribution for greater forkbeard (*Phycis blennoides*).

Blue ling (*Molva dypterigya*)

The total catch of blue ling was 598 kg (round weight) (Table 2). Highest catches were recorded on the Hatton Bank slopes. The absolute depth range for this species was 650 m – 1,540 m. Peak catch rates of blue ling came from 650 m to 1,300 m. (Table 7). The smallest length recorded was 41 cm for females and 70 cm for males. The greatest lengths were 94 cm for males and 129 cm for females (Figure 6). In addition two fish of undetermined sex were 130 cm and 135 cm.

Table 7. Blue ling (*Molva dypterigya*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	0.0	0.0	0.0
500 - 699 m	27.2	0.7	9.8	5.3
700 - 899 m	21.9	4.4	12.6	10.1
900 - 1099 m	19.9	9.9	15.9	12.1
1100 -1299 m	-	2.1	12.1	5.5
1300 - 1500 m	13.9	-	12.2	13.1
1500 - 1800 m	0.7	0.0	-	0.3
Total	18.4	2.4	7.9	5.3

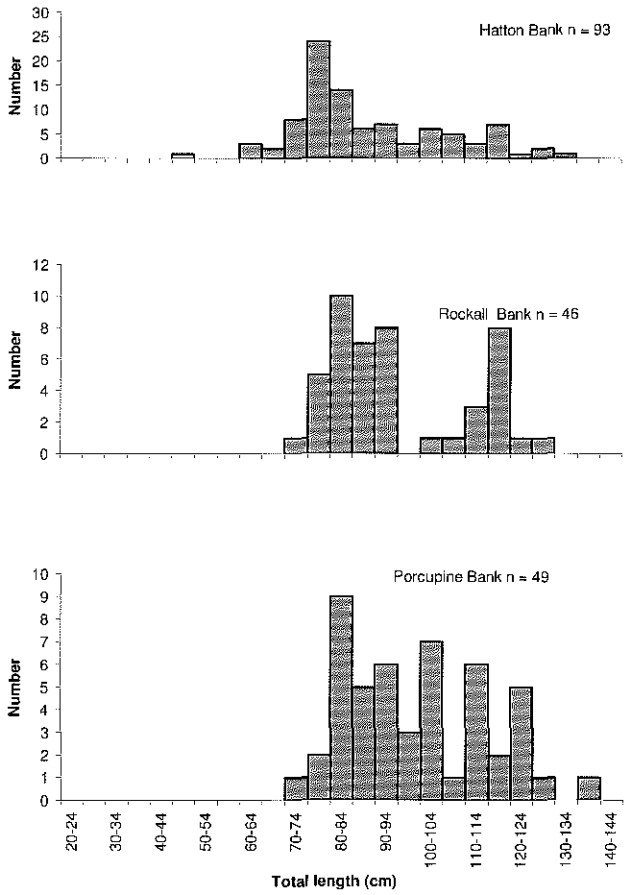


Figure 6. Length frequency distribution for blue ling (*Molva dypterigya*) (n = 141).

Portuguese dogfish (*Centroscymnus coelolepis*)

The total catch of Portuguese dogfish was 2,137 kg (Table 2). Highest catches were recorded on the Rockall and Hatton Bank slopes (Table 8). The absolute depth range for this species was 680 m – 1,550 m. Peak catch rates of Portuguese dogfish came from 1,020 m to 1,220 m. The smallest length recorded was 70 cm for females and 60 cm for males. The greatest lengths were 122 cm for males and 121 cm for females (Figure 7).

Table 8. Portuguese dogfish (*Centroscymnus coelolepis*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	0.0	0.0	0.0
500 - 699 m	0.0	0.4	0.0	0.3
700 - 899 m	0.0	0.0	0.0	0.0
900 - 1099 m	84.2	6.5	31.6	20.2
1100 -1299 m	-	133.3	84.4	117.0
1300 - 1500 m	19.5	-	59.0	39.2
1500 - 1800 m	17.8	0.0	-	8.9
Total	20.2	16.6	27.3	19.1

Leafsacale gulper shark (*Centrophorus squamosus*)

The total catch of leafscale gulper shark was 3,867 kg (round weight) (Table 2). Highest catches were recorded on the Porcupine slopes (Table 9). The absolute depth range for this species was 600 m – 1,540 m. Peak catch rates of leafscale gulper shark came from 800 m to 1,200 m.

The smallest length recorded was 81 cm for females and 84 cm for males. The greatest lengths were 120 cm for males and 135 cm for females. (Figure 8).

Table 9. Leafsacale gulper shark (*Centrophorus squamosus*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	0.0	0.0	0.0
500 - 699 m	0.6	4.9	0.0	3.9
700 - 899 m	10.7	182.1	20.5	108.1
900 - 1099 m	101.7	108.7	45.2	99.3
1100 -1299 m	-	100.2	6.5	68.9
1300 - 1500 m	21.4	-	3.3	12.3
1500 - 1800 m	3.6	0.0	-	1.8
Total	23.1	43.6	8.6	34.5

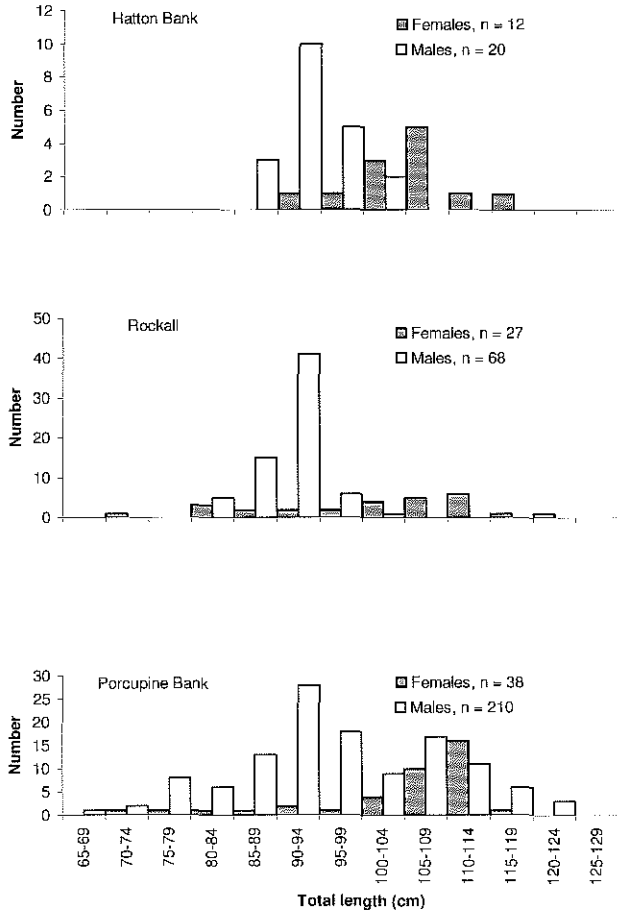


Figure 7. Length frequency distribution for Portuguese dogfish (*Centroscymnus coelolepis*).

Birdbeak dogfish (*Deania calceus*)

The total catch of birdbeak dogfish was 6,383 kg (round weight) (Table 1). High catch rates were recorded in all the investigated areas (Table 10). The absolute depth range for this species was 450 m – 1,200 m. Peak catch rates of birdbeak dogfish came from 700 m to 1,100 m.

The smallest length recorded was 52 cm for females and 48 cm for males. The greatest lengths were 106 cm for males and 113 cm for females (Figure 9).

Table 10. Birdbeak dogfish (*Deania calceus*), catch per unit effort (CPUE) in kg per 1,000 hooks, by areas and depth.

Depth interval	Hatton Bank	Porcupine Bank	Rockall Bank	Total
200 - 499 m	-	0.7	0.0	0.5
500 - 699 m	13.9	46.6	21.7	39.9
700 - 899 m	211.4	110.7	100.8	130.9
900 - 1099 m	48.6	232.0	117.9	192.3
1100 -1299 m	-	55.1	24.6	44.9
1300 - 1500 m	0.0	-	0.0	0.0
1500 - 1800 m	0.0	0.0	-	0.0
Total	48.0	65.7	30.5	56.9

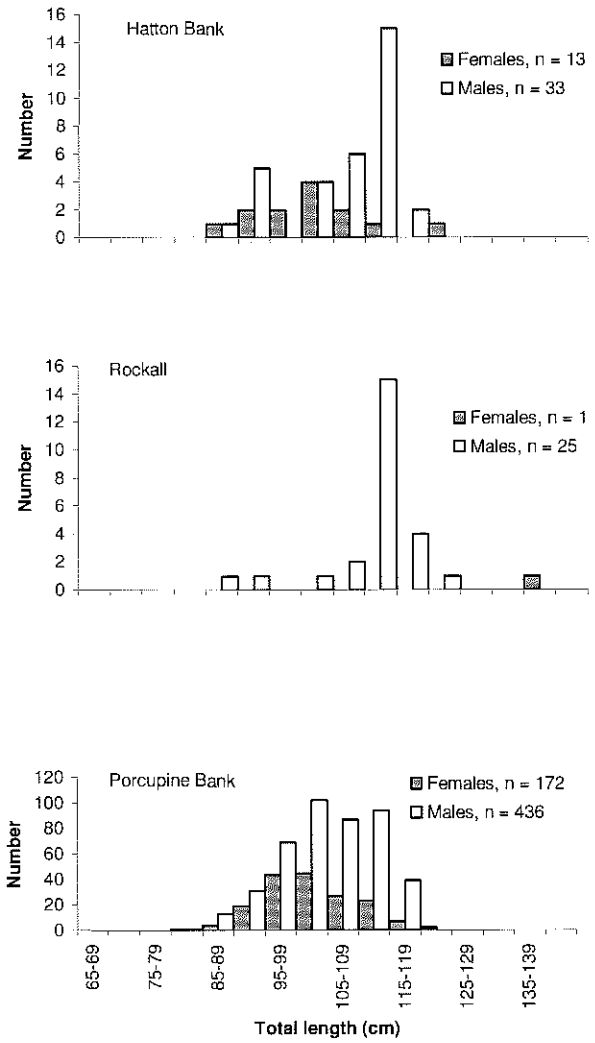


Figure 8. Length frequency distribution for Leafscale gulper shark (*Centrophorus squamosus*)

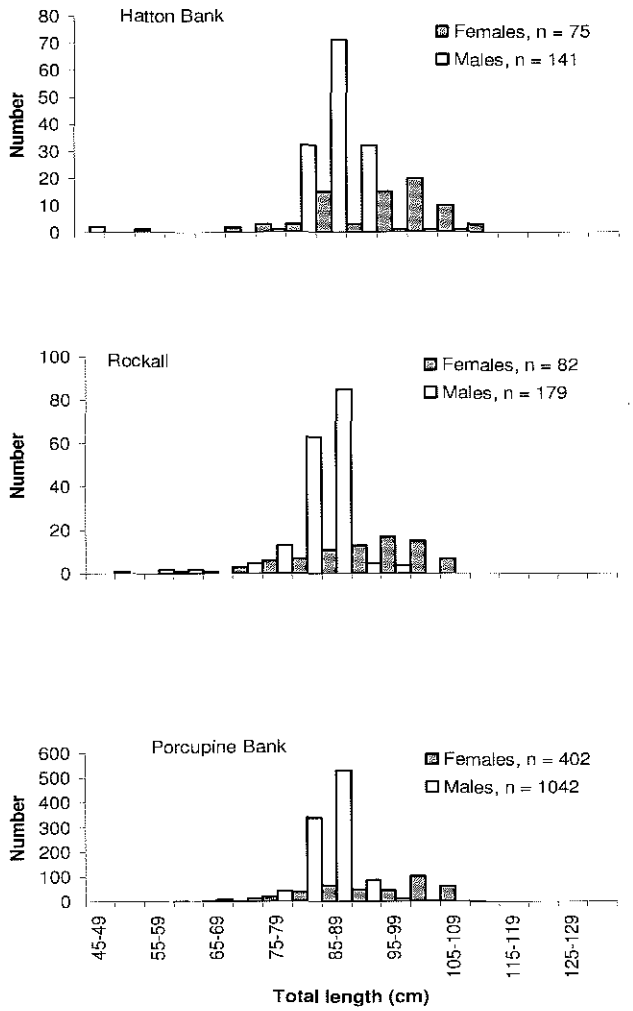


Figure 9. Length frequency distribution for birdbeak dogfish (*Deania calceus*)

Conclusion

This was the first Irish deepwater survey on the Hatton Bank. It provided additional information on the western slopes of the Rockall Bank. The great distance of these grounds from port meant that only a short amount of time could be allocated to each area. Future work on these banks should aim at a more comprehensive coverage of each.

The poor weather conditions during the Hatton part of the survey resulted in low catch rates of commercial fish. In some instances blue ling were seen to fall of the hooks due to the pitching of the vessel on the heavy seas. Thus this survey does not provide an accurate reflection of the catch composition of the area of the Hatton Bank studied. In addition, the areas of Greenland halibut concentrations were not

found. Catches of commercial fish were dominated by tusk, which remain tightly secured to the hooks, and sharks. However catches of Portuguese dogfish and leafscale gulper shark were lower than those recorded on the continental slopes in previous surveys. Catch rates on the western side of the Rockall Bank were poor except for some tusk in shallower settings. In deeper waters small sharks dominated the catch. On the Rockall Plateau the catch was mostly of tusk and haddock. The selective properties of long-line gear were highlighted by the fact that no haddock, and less than 5 % of the catch of ling or blue ling below minimum legal size were caught. This area was not fishable by trawlers and some smaller tusks were present. In particular long lining on the Porcupine Bank yielded poor returns, despite anecdotal evidence that good catches of haddock are to be found here.

In all areas, except the Rockall Plateau, non-commercial catches were dominated by small sharks. On shallower settings where tusk or ling were targeted discards were mainly black mouth dogfish. In waters deeper than 700 m bird-beak dogfish and small sharks dominated the catch. In this depth range the main commercial species was mora. Commercial fishing on the southern slopes of the Rockall Trough found good catches of mora, forkbeard and tusk, all non-quota species. While some of the catch of these species was below marketable size it would appear that this area is commercially viable. Discarding in this area was again mainly of birdbeak dogfish and black mouth dogfish.

A striking aspect of this study was the number of old gill-nets taken from lines in deep water. In some instances ling showed much damage due to these nets. It would appear that ghost fishing is a problem in the deep waters of this area. Future survey work to ascertain the extent of this problem in deep water is required.

Biological samples of blue ling, tusk and mora were secured from Rockall for analysis at the Marine Institute. This will be carried out as part of the on-going analysis of the biology of non-quota species. Samples were also secured for the food technology and product development programme underway at the Teagasc National Food Centre, supported by the Marine Institute. The data obtained in this survey will be presented in the scientific literature and at ICES working groups.

Acknowledgements

To Tony and the crew of *An Capall Ban*, Frode, Mark, Anthony, Antonio, Andrew, Paul, P.J., Rory, Johnny, Mick and Patrick are gratefully thanked for all their help and dedication during this survey. Thanks also to Padraig and Geraldine O'Malley and Nils-Roar Hareide for all their help. Special thanks go to Naomi Soffer who organised the final publication of this report.

Bibliography

Compagno, L.J.V. (1984) FAO Species Catalogue. Vol 4, Part 1. Sharks of the World. *FAO Fisheries Synopsis* 125, 4(1): 249pp.

Stehman M. (1998) Field key to common deep-water sharks in the North Atlantic. Shubert and Back, Hamburg.

Whitehead, P. J. P., M. L. Bauchot, J. C. Hureau, J. Nielsen, and E. Tortonese, (1984, 1986). *Fishes of the North-eastern Atlantic and the Mediterranean.* Paris: UNESCO.

Appendix

Catch per unit effort (CPUE) in kg per 1,000 hooks, at each setting for all species

Haul no.	Area	Date	Mean depth (m)	Time	Lat.	Lon.	No. Hooks	Tusk	Port. Dogfish	Leafscale g.shark	Cod	Blue ling	ling	Mora	Forkbeard	Total
1	14	22-Aug	654	720	57 42.40	18 43.80	2240	28.7				26.8			0.9	38.4
2	14	22-Aug	679	1007	57 44.10	18 45.40	2240	38.6		1.2		27.5		0.1		66.9
3	14	22-Aug	796	1655	57 47.20	18 57.10	2240	21.9		1.7		21.9		17.5		72.0
4	14	23-Aug	1024	820	57 52.90	19 11.00	2240	5.9	84.2	11.7		19.9				21.9
5	14	23-Aug	1292	1845	58 00.00	19 23.40	2240		19.5	21.4		13.9				54.9
6	14	24-Aug	1536	720	58 02.50	19 36.10	2240		17.8	3.6		0.7				22.8
7	13	25-Aug	695	825	57 07.20	16 35.80	2240	125.2				9.8		8.1		143.1
8	13	25-Aug	956	1035	57 08.60	16 36.40	2240	26.0	31.6	45.2		15.9		28.8		147.4
9	13	25-Aug	1130	1530	57 05.90	16 42.70	2240		115.7	6.6		1.9		1.6		125.7
10	13	26-Aug	1202	700	57 10.50	16 44.60	2240		53.5	6.4		22.4				81.9
11	13	26-Aug	1316	800	57 11.70	16 47.50	2240		59.0	3.3		12.2				74.4
12	13	26-Aug	750	1700	57 07.80	16 36.80	2240	89.8		2.5		12.6		22.4	1.5	146.8
13	11	27-Aug	167	1555	56 57.80	14 38.10	2240	51.8					0.9			52.6
14	11	27-Aug	171	1640	56 57.00	14 11.80	2240	9.4					2.2			92.4
15	11	28-Aug	168	605	56 57.40	14 42.30	3360	68.4					15.8			84.1
16	5	28-Aug	169	645	56 58.60	14 38.80	3360	1.3			0.6		14.5			115.3
17	5	29-Aug	682	651	54 18.70	11 23.50	2941	165.8	3.9	7.7		2.5	0.5	63.4	25.7	267.9
18	5	30-Aug	603	2110	54 18.10	11 23.40	2795	268.9		25.4				82.4	47.7	423.4
19	5	30-Aug	505	2225	54 17.00	11 25.50	2240	3.5					17.8		67.2	114.8
1	5	16-Sep	512	1140	54 02.11	12 08.87	1120	27.6					59.8		19.5	16.9
2	5	16-Sep	536	1230	54 00.56	12 14.46	3360	41.6					51.7		3.2	122.2
3	5	16-Sep	800	1330	54 00.12	12 18.58	1120	66.3				2.9	3.7	4.7	18.2	131.3
4	5	17-Sep	1000	727	54 02.36	12 17.07	3360	17.4		77.3		14.8		12.3	1.7	24.5
5	5	17-Sep	1000	850	54 03.40	12 19.00	3360	27.2		47.5		14.5		142.6	2.2	233.4
6	5	17-Sep	1000	1000	54 07.10	12 18.20	1120		34.8	5.9						4.7
7	5	18-Sep	1200	630	54 06.54	12 15.97	3360		14.6	135.4		1.6				276.7
8	5	18-Sep	1200	730	54 06.90	12 09.00	3360		192.0	12.3		4.6				298.4
9	5	18-Sep	1600	940	54 08.90	12 17.10	1120									
10	5	18-Sep	1800	1745	54 10.50	12 18.20	1120									
11	5	19-Sep	249	349	53 25.11	13 03.09	2240	1.6					14.8			15.7
12	5	19-Sep	239	1615	53 25.45	13 06.16	2240						17.6			17.6
13	5	20-Sep	170	705	53 27.01	13 23.56	3360				0.4		1.1			1.2
14	5	20-Sep	173	745	53 26.30	13 19.20	3360									
15	5	20-Sep	174	825	53 28.40	13 27.60	3360				1.7		3.6			5.3
16	5	20-Sep	1150	2235	53 51.60	13 58.20	2240		35.3	44.6				0.4		8.4
17	5	21-Sep	450	700	53 45.78	13 47.40	2240	8.4					5.6	1.5		15.7
18	5	21-Sep	600	730	53 47.18	13 50.90	2240	41.6				1.6	53.5	5.4	26.4	128.6
19	5	21-Sep	900	1726	53 49.41	13 55.80	2240			24.9		7.6		18.5	0.9	232.0
20	5	22-Sep	560	720	53 45.55	13 51.56	2240	45.5				2.5	11.3		12.5	17.1
21	5	23-Sep	486	750	54 21.68	11 20.34	2240	4.3					13.6		14.7	32.6
22	5	23-Sep	800	830	54 24.10	11 24.06	2240			441.9		5.9		1.2		458.3
23	5	23-Sep	960	1427	54 24.45	11 25.93	2240		18.4	23.4		3.1	5.1	7.6		237.2
24	5	23-Sep	718	1847	54 24.90	11 21.00	2240	85.0		13.4		3.5		23.3	2.0	136.9
25	5	24-Sep	500	715	54 27.45	11 09.00	2240	13.1					15.2		23.5	51.8
26	5	24-Sep	650	730	54 24.33	11 13.52	2240	139.6		9.9			2.6	59.4	21.5	233.0
27	5	24-Sep	500	1755	54 09.82	11 42.88	2240	45.1					46.5	0.1	34.4	126.2
28	5	25-Sep	308	712	53 50.45	11 50.64	2240	16.2					1.7		1.3	28.3

Appendix continued.

Haul no.	Date	A. carbo	A. laursonii	A.denticulatus	A.rostrata	C. coelorhynchus	C. congro	C. crepidater	C. fabricii	C. monstrosa	C. rupestris	C. thompsoni	D. calceus	D. licha	E. princeps	E. spinax	G. melastomus	G. morhua	G. murinus	Grey gurnard	H. affinus	H. dactylopterus	H. griseus	H. pallidus
1	22-Aug												11.4			0.8								
2	22-Aug									0.8			16.8			0.3	66.8							
3	22-Aug							30.0					211.4			0.7	54.1		2.2					
4	23-Aug		3.8					148.8		2.9			48.6		59.0		0.3							
5	23-Aug		0.3			0.9									141.9									
6	24-Aug				7.9	0.1			2.9						3.4									
7	25-Aug							1.1		3.7			21.7			18.7	13.4							
8	25-Aug		7.3					62.7		1.2			117.9			2.4			0.8					
9	25-Aug		11.2					69.7	8.6				49.2		23.9	43.3								
10	26-Aug		1.1			0.1		11.6	232.5						149.3									
11	26-Aug		0.3					23.3	281.4															
12	26-Aug		0.4					2.0					1.8			24.3	2.8							
13	27-Aug			0.8																				
14	27-Aug			1.8																				
15	28-Aug			5.9																				
16	28-Aug			4.2														0.6				0.1		
17	29-Aug	0.7								8.3			1.7	1.2			0.4					21.7		
18	30-Aug									26.0			87.7				0.8					12.9		
19	30-Aug									69.4			41.2			0.1	0.1					37.7	1.7	
1	16-Sep									1.6												35.9		
2	16-Sep									28.2				3.6			2.0					33.2		
3	16-Sep												75.1			0.5	1.4					7.0		
4	17-Sep	1.9						2.4		5.0			37.5		0.7							6.7		
5	17-Sep												125.6		2.5							1.3		
6	17-Sep														23.3									
7	18-Sep							27.7	5.7				97.8		83.3				0.1					
8	18-Sep		0.6					15.9					41.7		85.7									
9	18-Sep				1.4										0.4									
10	18-Sep		1.7		12.5										0.8						12.7			38.9
11	19-Sep																					8.3	2.7	
12	19-Sep																					6.2		
13	20-Sep																	0.4						
14	20-Sep																							
15	20-Sep																	1.7		0.9				
16	20-Sep					0.7		24.3	3.1		0.2		12.2											
17	21-Sep									8.2			6.0			0.4						16.5		
18	21-Sep									24.9			46.9			0.8						36.4	2.6	
19	21-Sep							11.6		2.6			425.8						1.3					
20	22-Sep						0.5			25.4						1.6						33.2	1.7	
21	23-Sep									4.5			1.2									14.3		
22	23-Sep												12.4											
23	23-Sep							21.7	1.4	1.6			2.3		2.5				1.8					
24	23-Sep					0.5				3.9			118.7									4.6		
25	24-Sep									15.2												22.7		
26	24-Sep									6.5			159.6			0.4						24.2		
27	24-Sep						0.8	0.7		5.2			3.2			1.3						11.7		
28	25-Sep																							

Appendix continued.

Haul no.	Date	L. eques	L. piscatorius	L. schmidti	L.whiffagonis	M. aeglifinus	M. berglax	P. virens	R. batis	R. bigelowi	R. circularis	R. fullonica	R. fyllae	R. naevus	R. nidarosiensis	R. hippoglossoides	S. Acanthius	S. Canicula	S. kaupi	S. mentella	S. ringens
1	22-Aug	0.2																			
2	22-Aug	0.9							6.2							3.6					
3	22-Aug	0.5																			
4	23-Aug											0.2									
5	23-Aug						3.8						2.9						0.3		
6	24-Aug						7.3														
7	25-Aug	0.2																			
8	25-Aug	0.4																			
9	25-Aug									0.3											
10	26-Aug												1.9						0.5		
11	26-Aug						0.9						0.6			0.9			0.1		
12	26-Aug	0.4																			
13	27-Aug				0.6	11.3															
14	27-Aug		2.6			1.8															
15	28-Aug				0.1	12.6		3.1													
16	28-Aug		2.9		0.6	25.7															
17	29-Aug	0.9																			17.3
18	30-Aug	0.3	2.2									4.6									2.7
19	30-Aug		2.9								8.3										
1	16-Sep										8.8										
2	16-Sep										6.9										
3	16-Sep	0.3									1.3										
4	17-Sep	0.7																			
5	17-Sep	0.4																			
6	17-Sep																				
7	18-Sep	0.9																	0.8		
8	18-Sep	0.3																	0.2		
9	18-Sep																				
10	18-Sep			2.5																	
11	19-Sep							2.9									1.7	14.7			
12	19-Sep					5.5								2.9			0.9	5.7			
13	20-Sep					4.2								17.6			1.4	1.4			
14	20-Sep					1.9		0.3						0.3				0.3			
15	20-Sep					0.9		0.4				1.2		13.8				5.3			
16	20-Sep														12.3				0.8		
17	21-Sep																				
18	21-Sep										19.4										
19	21-Sep	0.1	2.8						12.4		5.9										
20	22-Sep										11.4										
21	23-Sep	0.2	1.2																	0.8	
22	23-Sep	0.1																			
23	23-Sep	0.2																			
24	23-Sep	1.2																			
25	24-Sep																				
26	24-Sep	0.3	0.8																		
27	24-Sep										3.2										
28	25-Sep																				

www.marine.ie

ISSN 0332 1789

HEADQUARTERS

MARINE INSTITUTE
Rinville
Oranmore
Co. Galway
Tel: +353 91 387 200
Fax: +353 91 387 201
Email: institute.mail@marine.ie

MARINE INSTITUTE REGIONAL OFFICES & LABORATORIES

MARINE INSTITUTE
80 Harcourt Street
Dublin 2
Tel: +353 1 4766500
Fax: +353 1 4784988

MARINE INSTITUTE
Furnace
Newport
Co. Mayo
Tel: +353 98 42300
Fax: +353 98 42340